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TECHNICAL MEMORANDUM

TO: **Bill Dana - DEQ Project Officer**

FROM: **Kevin McGillivray - E & E** KMG

THRU: **John Montgomery - E & E Project Manager**

SUBJ: **McCormick and Baxter - Performance of Passive LNAPL Skimmer Units in Two Site Wells and Recommendations to Purchase and Install Additional Skimmers.**

DATE: **June 17, 1998**

CC: **David Anderson - DEQ**

INTRODUCTION

Ecology & Environment (E & E) has prepared this technical memorandum to present an evaluation of the existing LNAPL passive recovery skimmers with recommendations of their expanded use.

BACKGROUND

Previous discussion of LNAPL recovery via the use of passive skimmer units was provided in an April 14, 1997, Technical Memorandum to Bill Dana, from David Anderson and Mike Witnauer of E & E. A letter dated March 20, 1997, to DEQ also provided comment and recommendation by E & E on the purchase of the same passive skimmers to improve LNAPL recovery at the site.

E & E purchased two passive skimmers from Site Remediation, Inc., and were installed in wells MW-1s and EW-15s during June 1997. The skimmers have been used as an ongoing manual recovery method for LNAPL that accumulates in these two wells. Wells MW-1s and EW-15s were selected for passive skimmer installation based on their history of accumulating substantial

LNAPL thicknesses without the presence of DNAPL in the well. It was considered that manual recovery from a LNAPL-only well would be simpler and easier to monitor.

Use of the passive skimmer units is one of two methods of manual, or non-automated, extraction at the site. The other method incorporates an active extraction pump system to remove either LNAPL or DNAPL from site wells. On a weekly basis, a portable pneumatic pulse-type pump is used at each well where significant (greater than about one-half foot) accumulations of LNAPL or DNAPL is present. The NAPL is pumped from the well to a small storage container. The NAPL recovered by both manual extraction methods is subsequently dispensed to either of the two large on-site NAPL storage tanks.

Both manual extraction methods are conducted on a weekly basis as needed for identifying and reducing LNAPL in site wells. The active version of manual extraction, which uses mobile pneumatic pumping , has been responsible for the majority of the approximately 328 gallons of total NAPL (LNAPL and DNAPL) recovered from the site wells using both manual extraction methods in the twelve months since June 1st 1997.

EQUIPMENT DESCRIPTION AND PERFORMANCE

The equipment used for passive collection of LNAPL in MW-1s and EW-15s is the KLEER Remedial Support Skimmer, model RSS25, manufactured by Site Remediation, Inc. of Toronto, Ontario, Canada. Two identical skimmer units were shipped May 23, 1997 and were subsequently installed within two weeks. See the Attachment - "Product Illustration."

The Kleer RSS25 units are the only known passive type of skimmer designed for 2-inch diameter wells. (Well MW-1s has a 2-inch diameter casing and EW-15s has a 4-inch casing.) The standard Kleer RSS25 skimmer includes a single filter section of approximately twelve inches in length with a membrane suitable for gasoline and light solvent collection. The unit is equipped with a clear 500-ml reservoir in the bottom half of the skimmer and a 10-ft long brass chain. The Skimmer body is constructed of PVC.

A standard RSS25 skimmer is approximately $399 per unit, plus shipping from Toronto, Canada. Standard models are available for 3-inch and 4-inch wells and are priced at $736 and $849 per unit, respectively.

The actual 2-inch units installed at this site were upgraded to include an extra length of filter section to accommodate fluctuations in the water table and increase collection capacity. The membrane for each filter section was also upgraded to a "diesel/ light oil" capability for the type of LNAPL at this site. Total combined cost for the two units with upgrades was $1,318, plus $135 for shipping.

Method of Operation

The two skimmer units are passive; that is, the transfer mechanism of the skimmer requires no significant energy to collect and transfer the LNAPL above ground. They have no moving parts and require manual emptying of LNAPL that has accumulated inside the skimmer reservoir.

The technology behind the KLEER Remedial Support Skimmer product is an oleophilic (hydrophobic) membrane which prohibits water from passing but allows the LNAPL or hydrocarbon liquid to transmit through the membrane and collect in the reservoir in the bottom of the skimmer. A filter section consists of the oleophilic membrane wrapped onto a slotted PVC pipe, a protective fabric placed on the outside of the membrane and an outer 1-1/2-inch diameter slotted PVC pipe that protects the filter and membrane within.

The skimmer is installed inside each well at the LNAPL-water interface and suspended on a manually-adjusted length of chain which is secured to the well monument above. The skimmer floats in the water until it is full of LNAPL, then submerges until the support chain is tight. In order for the skimmer to collect LNAPL, it is critical that the LNAPL-water interface intersects the filter section of the skimmer.

Each time a passive skimmer is checked, the technician evaluates whether the skimmer is suspended too high above the LNAPL/water interface or is full and/or submerged in the water column. Each situation results in a missed opportunity to collect LNAPL. Accordingly, the technician may need to adjust the vertical position each time the skimmers are inspected or emptied. In addition, the technician must determine if the skimmer chain length must be altered in order to accommodate near-term changes in the water table elevation. Changes in well water levels are difficult to anticipate several days in advance. On occasion, a skimmer has been found suspended above a lowered water-LNAPL interface just a few days after being readjusted.

Since June, 1997, the two passive skimmers have been checked and emptied on a weekly basis during the routine weekly LNAPL, DNAPL, and water level measurement events. This schedule of emptying the skimmer units on a weekly basis appears to be adequate for optimum LNAPL removal from the wells.

Historically, if LNAPL is present in the well, then LNAPL will be found within the skimmer reservoir. The manufacturer claims that floating petroleum hydrocarbons can effectively be removed to a sheen layer. Interface probe field measurements have confirmed this claim.

Operation of a KLEER passive skimmer unit is optimized as long as the filter section is situated at the LNAPL-water interface and the skimmer unit is emptied before the collection reservoir reaches full capacity (causing submersion). Specifically, interferences with optimum operations occur due to the following reasons:

- The KLEER units are improperly suspended above the LNAPL level in the well;
- Static water levels drop below the filter section before the technician returns to adjust the skimmer level; or
- An event occurs where a rapid accumulation of LNAPL inside a well causes submergence before the technician is able to empty the skimmer.

Weekly onsite well monitoring and operation of these skimmer units over the past year has shown that rapid accumulation of LNAPL in most of the site wells does not regularly occur nor can it be predicted with great reliability using other physical means.

Maintenance of the skimmer units is minimal. After approximately nine months of use, the collection efficiency has diminished slightly (i.e., skimmer reservoirs were not filling completely in the presence of one inch or more of LNAPL thicknesses). According to manufacturer's recommendations, removal efficiency can be restored by cleaning the filter sections (above-ground and within containment) using mineral spirits. Cleaning the skimmer units in this manner twice yearly should prevent filter clogging in the future.

Performance Summary

In general, the passive skimmer units installed in wells MW-1s and EW-10s have performed well, as an easy and reliable method to monitor LNAPL entering each well, and to collect

moderate amounts (500 ml or less) for manual removal during the weekly round of monitoring well inspections. The skimmers are simple to use and require very little time or effort to collect and remove LNAPL on a routine basis. Attending to the skimmer units on a weekly basis should be adequate for the majority of situations of LNAPL accumulation and water elevation conditions encountered at the site. Clear and standardized instructions on the use, adjustment, and maintenance of the skimmer units will be implemented at the site. Finally, providing more frequent inspections in response to situations where the LNAPL accumulation rate suddenly increases and/or water elevations rapidly decrease will optimize the effectiveness of the passive skimmer units.

RECOMMENDATIONS

Based on the effective performance of the KLEER passive skimmer units in collecting LNAPL over the past year, we recommend the purchase and installation of additional skimmer units at the site. The monitoring and recovery of LNAPL can be improved by installing passive skimmer units at site wells which have historically and currently produced significant amounts of LNAPL which are currently removed by mobile pump extraction. Specifically, wells MW-Rs and EW-17s, located in the Tank Farm Area, and MW-21s in the Former Waste Disposal Area, should receive new passive skimmer units. These wells have historically contained substantial amounts of LNAPL (greater than one foot).

In addition, we recommend that well EW-15s, which has produced significant amounts of LNAPL both in rapid accumulation periods and in regular amounts throughout the year, be fitted with an *active* skimmer version of the KLEER Remedial Support Skimmer unit. The pump and controller supplied with an active model such as the RSS25-P (12Vdc electric) or -PA (pneumatic) will eliminate the likelihood of missed opportunities to collect more LNAPL than the passive version during periods of rapid accumulation. In addition, a KLEER active skimmer unit will provide a price and performance comparison to the more sophisticated and costlier Spillbuster Magnum automated unit, proposed for installation in well EW-10s.

The approximate base cost for a passive skimmer unit RSS25 is $399. Membrane upgrade (to handle the diesel-like consistency) costs $90 per 12-inch filter section, and one or two extra lengths of filter (to accommodate fluctuating interface levels) is $115 per 12-inch section. Thus, three new passive skimmer units for 2-inch wells with three feet of filter section would total approximately $2,700 plus shipping. Note, substituting two of the above passive skimmer units

with 3-inch sizes (increasing reservoir capacity four times, to 2,100 ml; well MW-Rs is a 2-inch well) would cost approximately $2,566, plus shipping for the two units.

One automatic, active skimmer unit which includes special hose/power line harness, timed controller, and pump costs $2,629 for the 12Vdc electric-powered unit and approximately $1,400 for the pneumatic-powered unit. Shipping costs and specific installation expenses are not included in this estimate.

E & E recommends the purchase of four KLEER, LNAPL skimmers for use at the site. One two-inch passive skimmer will be placed in MW-Rs, two three-inch passive skimmers will be placed in EW-17s and MW-21s, and one active 12V dc skimmer will be placed in EW-15s. A cost breakdown of these recommendations is provided in Table 1.

Table 1

Proposed Purchase Recommendations for LNAPL Enhancement
McCormick & Baxter Creosoting Company
Portland, Oregon

Well Number	Well Diameter	Location	Proposed Skimmer Mfg./ Type	Model Number	2-inch Unit Cost*	3-inch Unit Cost*
MW-Rs	2-inch	TFA	KLEER/Passive	RSS25	$900.00	-
EW-17S	4-inch	TFA	KLEER/Passive	RSS25	-	$1,283.00
MW-21s	4-inch	FWDA	KLEER/Passive	RSS25	-	$1,283.00
EW-15s	4-inch	FWDA	KLEER/Remedial Support/Active	RSS25-P	- -	$2,629.00 -
Total Cost for 4 Units						**$6,095.00**

Notes:

* Includes cost for membrane upgrade, additional 12-inch filter section, and shipping.

The active skimmer proposed for EW-15s does not include shipping and installation expense.